REMARKS

Claims 1-5 are pending in the present application. Claim 1 is herein amended.

Claim Rejections - 35 U.S.C. § 102

Claims 1-5 were rejected under 35 U.S.C. § 102(b) as being anticipated by **Hamrock** (U.S. Patent No. 6,063,522). Favorable reconsideration is requested.

Applicants respectfully submit that the Office Action improperly relies on a secondary reference in addition to Hamrock to reject the claims under § 102 for anticipation. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." MPEP § 2121. The Office Action relies on Hamrock and the permapure.com website. Therefore, the rejection is improper under § 102.

Applicants respectfully submit that Hamrock does not disclose that "the separator has a melting point of higher than 185 °C" as recited in claim 1.

The Office Action cites the microporous polymer separator in Hamrock as corresponding to the separator as recited in claim 1. (Office Action, pages 2-3.) Hamrock does not disclose using Nafion. However, the Office Action cites an additional reference for disclosing that Nafion is a commonly used microporous membrane separator material. (Office Action, page 3, citing http://www. permapure.com/TechNotes/Temperature%20Effects.htm.) The Office Action also cites the additional reference for disclosing that Nafion is a separator material that has a melting point of 200 °C.

However, one of ordinary skill in the art would not use Nafion as a separator for non-aqueous electrolytic secondary cells. Nafion is used as a separator of fuel cells and as an ion exchange resin. A Nafion film is a copolymer of perfluorosulfonic acid and PTFE with a So_3H group. Also, the film contains moisture. (*See* http://www.dupont.com/fuelcells/pdf/dfcl01.pdf). It is well known that the So_3H group and moisture react with lithium and lithium ions and thus adversely affect cells. One of ordinary skill would not use Nafion as a separator of non-aqueous electrolytic cells. Thus, Nafion is not a commonly used microporous membrane separator material for non-aqueous electrolytic cells as recited in claim 1 and is improperly relied on by the Office Action.

Therefore, Hamrock does not disclose using a separator having a melting point of higher than 185 °C.

Applicants also respectfully submit that Hamrock does not disclose "the main component being 90% to 100% by volume of the total volume of the non-aqueous solvent" as recited in amended claim 1.

In claim 1, the compound represented by general formula (1), where X and Y are independently a methyl group or an ethyl group, and n is 2 or 3, constitutes 90% to 100% by volume of the total (the compound of formula (1) and the other minor components combined) volume of the non-aqueous solvent. Claim 1 has been amended to more clearly recite this.

In the present invention, by specifying the volume of the compound represented by general formula (1) to 90% to 100%, the cell has no abnormality in high temperature preservation tests and reflow resistance tests and cell swelling in reflow resistance tests is restricted to 0.15%-1.40%. The cell also excels in discharging characteristics such that the relative discharging capacity is 82-103%. (*See* Table 2.)

The Office Action takes the position that the 50/50 blends of solvents disclosed in the specific examples of Hamrock can combine to form a main component which is 100% by volume of the solvent. The Office Action also states that 50/50 blends of solvents are not required by Hamrock, and thus, if only one solvent is used, it would be 100% by volume of the solvent.

However, in specific examples 1-13 of Hamrock, none of the solvents used meet the requirements of claim 1. Specifically, none of the solvents have the general formula (1) where X and Y are independently a methyl group or an ethyl group, and n is 2 or 3. Thus the Examiner incorrectly states that the 50/50 blends disclosed in the examples can be combined to form 100% by volume of the "main component" since none of the components in the specific examples are main components as defined in claim 1.

Diethylene glycol dimethyl ether ("DGM") is disclosed in the present specification as meeting the requirements of claim 1. (Specification, page 7, lines 14-17.) Hamrock discloses that DGM is one suitable aprotic liquid in a list of many compounds, for use in a battery. (Col. 13, line 52 to col. 14, line 9.) However, specific examples 1-13 all disclose using 50/50 blends of solvents, none of which meet the requirements of claim 1.

Furthermore, even if DGM were substituted in one of the 50/50 blends disclosed in Hamrock, it would be 50% at most of the total solvent with the other 50% being a solvent which does not meet the requirements of a "main component" as recited in claim 1.

Therefore, Hamrock does not disclose the main component being 90% to 100% by volume of the total volume of the non-aqueous solvent as recited in claim 1.

Accordingly, withdrawal of the rejection of claims 1-5 under § 102 based on Hamrock is hereby solicited.

Claim Rejections – Double Patenting

Claims 1-3 were provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 4-6 of copending Applications 10/787,749 and 10/785,970.

Applicants will address the provisional rejection for obviousness-type double patenting once all other claim rejections have been withdrawn.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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Enclosure: Dupont Fuel Cells (http://www.dupont.com/fuelcells/pdf/dfcl01.pdf)

http://www.dupont.com/fuelcells/pdf/dfc101.pdf

DuPont Fuel Cells

DuPont™ Nafion® PFSA Membranes NE-1135, N-115, N-117, NE-1110

Membranes

Description

DuPont™ Nafion® PFSA membranes are non-reinforced films based on Nafion® PFSA polymer, a perfluorosulfonic acid/PTFE copolymer in the acid (H+) form. Nafion® PFSA membranes are widely used for Proton Exchange Membrane (PEM) fuel cells and water electrolyzers. The membrane performs as a separator and solid electrolyte in a variety of electrochemical cells that require the membrane to selectively transport cations across the cell junction. The polymer is chemically resistant and durable.

Order and Packaging Information

Membrane dimensions are based on dry product conditioned at 23 °C and 50% Relative Humidity before cutting. The membrane's water content will affect its dimensions, and the change may not be symmetrical in the length, width, and thickness directions. In addition, certain conditioning steps performed by the customer also may affect the dimensions. Customers may wish to review their membrane treatment steps and dimensional requirements with a Nafion® Technical Representative before establishing membrane shipping dimensions.

Standard dry product dimensions for individual pieces include:

Width: 0.30 m (min.) to 1.22 m (max.)

Length: 0.30 m (min.) to 1.22 m (max.)

The membrane delivery package for cut pieces will depend on the size and quantity of the membrane order. Smaller-sized membranes are shipped flat, while longer lengths of individual pieces are shipped on a roll. The membranes are protected with a polyethylene wrap and inner packaging, then placed in shipping containers.

Standard dry product dimensions for roll goods include:

Width: 12-in (0.305-m) and 24-in (0.610-m) standard roll widths, and roll widths from 0.20-m (min.) up to 1.22-m (max.) on special order. Intermediate widths available in increments of 0.125-in.

Length: 50-meter standard roll length

There is a 100 m^2 minimum order requirement for non-standard roll widths and lengths. Membrane pieces or rolls can be cut to custom sizes, and special packaging provided at additional cost and/or delivery time. Please contact Nafion® Customer Service for details.

Properties of Nafion® PFSA Membrane

A. Thickness and Basis Weight Properties[1]

Membrane Type	Typical Thickness (microns)	Basis Weight (g/m^2)
NE-1135	89	190
N-115	127	250
N-117	183	360
NE-1110	254	500

B. Physical and Other Properties[2]

Property	Typical Value	Test Method
Physical Properties		
Tensile Modulus, MPa (kpsi)		
50% RH, 23 °C	249 (36)	ASTM D 882
water soaked, 23 °C	114 (16)	ASTM D 882
water soaked, 100 °C	64 (9.4)	ASTM D 882
Tensile Strength, maximum, MPa (kpsi)		
50% RH, 23 °C	43 (6.2) in MD, 32 (4.6) in TD	ASTM D 882
water soaked, 23 °C	34 (4.9) in MD, 26 (3.8) in TD	ASTM D 882
water soaked, 100 °C	25 (3.6) in MD, 24 (3.5) in TD	ASTM D 882
Elongation at Break, %		
50% RH, 23 °C	225 in MD, 310 in TD	ASTM D 882
water soaked, 23 °C	200 in MD, 275 in TD	ASTM D 882
water soaked, 100 °C	180 in MD, 240 in TD	ASTM D 882
Tear Resistance - Initial, g/mm		
50% RH, 23 °C	6000 in MD, TD	ASTM D 1004
water soaked, 23 °C	3500 in MD, TD	ASTM D 1004
water soaked, 100 °C	3000 in MD, TD	ASTM D 1004
Tear Resistance[3] - Propagating, g/mm		
50% RH, 23 °C	>100 in MD, >150 in TD	ASTM D 1922
water soaked, 23 °C	92 in MD, 104 in TD	ASTM D 1922
water soaked, 100 °C	74 in MD, 85 in TD	ASTM D 1922
Specific Gravity 1.98	—	
Other Properties		
Conductivity, S/cm	0.10 min	see footnote[4]
Available Acid Capacity, meq/g	0.90 min	see footnote[5]
Total Acid Capacity, meq/g	0.95 to 1.01	see footnote[5]

[1] Measurements taken with membrane conditioned to 23 °C, 50% relative humidity (RH).

[2] Physical Properties measured for N-115. Where specified, MD - machine direction, TD - transverse direction. Conditioning state of membrane given. Measurements taken at 23 °C, 50% RH.

[3] Tear resistance (g/mm) of dry membrane increases with thickness. Values given measured using 50 micron membrane.

[4] Conductivity measurement as described by Zawodzinski, et.al, *J. Phys. Chem.*, 95 (15), 6040 (1991). Membrane conditioned in 100 °C water for 1 hour. Measurement cell submersed in 25 °C D.I. water during experiment. Membrane impedance (real) taken at zero imaginary impedance.

[5] A base titration procedure measures the equivalents of sulfonic acid in the polymer, and uses the measurement to calculate the acid capacity or equivalent weight of the membrane.

Properties of Nafion® PFSA Membrane

C. Hydrolytic Properties[2]

Property	Typical Value	Test Method
Hydrolytic Properties		
Water content, % water[6]	5	ASTM D 570
Water uptake, % water[8]	38	ASTM D 570
Thickness change, % increase		
from 50% RH, 23 °C to water soaked, 23 °C	10	ASTM D 756
from 50% RH, 23 °C to water soaked, 100 °C	14	ASTM D 756
Linear expansion, % increase[9]		
from 50% RH, 23 °C to water soaked, 23 °C	10	ASTM D 756
from 50% RH, 23 °C to water soaked, 100 °C	15	ASTM D 756

Recommended Roll Storage Conditions

Unopened roll packages of Nafion® PFSA membrane should be stored in the original shipping box, out of direct sunlight, and in a climate-controlled environment, maintained at 10 to 30°C, and 30 to 70% relative humidity. Before opening the package, pre-condition the membrane roll to the processing area temperature for 24 hours.

Once opened and exposed to the environment, the membrane will equilibrate to the ambient relative humidity, and change in dimensions accordingly. Membrane order dimensions are specified and measured at 23°C and 50% Relative Humidity.

Handling Practices

Ventilation should be provided for safe handling and processing of Nafion® PFSA membrane. The amount of local exhaust necessary for processing Nafion® PFSA membrane at elevated temperatures will depend on the combined factors of membrane quantity, temperature, and exposure time.

Scrap Disposal

Preferred disposal options are (1) recycling and (2) landfill. Incinerate only if incinerator is capable of scrubbing-out hydrogen fluoride and other acidic combustion products. Treatment, storage, transportation, and disposal must be in accordance with applicable federal, state/provincial and local regulations.

Safe Handling and Use of Nafion® PFSA Membranes

The following information should be reviewed before handling and processing Nafion® PFSA Membranes:

- DuPont Material Safety Data Sheet for Nafion® PFSA Membranes NE-1135, N-115, N-117 and N-1110
- Nafion® Technical Information "Safe Handling and Use"
- "Guide to Safe Handling of Fluoropolymer Resins", Third Edition, June 1998, Published by the Fluoropolymers Division of the Society of the Plastics Industry, Inc.

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[7] Water content of membrane conditioned to 23 °C, 50% relative humidity (RH), compared to dry weight basis.
[8] Water uptake from dry membrane to water soaked at 100 °C for 1 hour (dry weight basis).
[9] Typical MD and TD values. MD expansion is slightly less than TD.

For more information about Nafion® contact:

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Fayetteville, NC 28306, U.S.A.

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Domestic U.S.A. only: (800) 436-1336
Overseas: (910) 678-1337
Fax: (910) 678-1342

Visit DuPont Fuel Cells at: http//www.fuelcells.dupont.com

The data listed here fall within the normal range of product properties, but they should not be used to establish specification limits nor used alone as the basis of design. This information is based on technical data that DuPont believes to be reliable. It is intended for use by persons having technical skill and at their own discretion and risk. This information is given with the understanding that those using it will satisfy themselves that their particular conditions of use present no health or safety hazards. Because conditions of product use are outside our control, DuPont makes no warranties, express or implied, and assumes no obligation or liability in connection with any use of this information or for results obtained in reliance thereon. The disclosure of the information is not a license to operate under or a recommendation to infringe any patent of DuPont or others.

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